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Developing the systems man of the future

Education and the Systems Man

by Allen Y. Davis

(Adapted from a talk given before the Cleveland Chapter of SPA, April 1957)

► Discussing education within the framework of SPA has some special implications. We are concerned with educating a new generation of systems men who will take over from us in the future, and carry systems work to points of development which we have hardly suspected up to now.

In another sense, when we discuss education within SPA, we are inevitably talking about our own education. Systems, as a profession, isn't a body of doctrine or knowledge which has been bottled and preserved. For most men, it is a field still alive with the possibility of new discovery, new skills, new applications, and new horizons.

Allen Y. Davis is Manager of the Systems Department at Chas. Pfizer & Company, Inc., Brooklyn, N. Y., and is a past national president of SPA.

Whether we think of ourselves and the education which we are still giving ourselves, or the tremendous number of new recruits who must be trained for the administrative and paperwork problems of the future, we properly have been concerned with the questions of learning more, and of passing on what we know now.

SPA has been built on the idea of the free and intimate exchange of systems information, and on this basis has grown at a rate which has resulted in an established organization of well over 2000 people. As a profession, it is soundly established as a necessary and fruitful adjunct of modern management.

The concern which SPA has felt for education is diagnostic of its feeling for the responsibilities of professionalism. The field has been established for many years, but the Association, after its first ten years, is only now in a position to institutionalize its efforts at educating others.

In the coming five or ten years, we have a choice of teaching and passing on the "classical" systems education which is based primarily in technique, or of leading into a more dynamic and diversified

definition of the systems field, in which the horizons have been rolled back, and new disciplines are brought firmly within the scope of systems work.

First Choice

There are good arguments for the first choice. We are good at what we know, better, I think, than anyone else now working in this area. The skills and techniques which can be taught in the "classical" exposition of the field have produced results, and will continue to do so when properly applied. The final harvest has not been reaped yet, and the techniques will be used for years to come in the thousands of businesses in this country.

The difficulties with this first choice lie largely in the fact that too much concentration here will generate a group of technicians who will know only the mechanics of their jobs, and who will forget or never learn the wider purposes which they may serve. If the means become the end, the field will suffer the penalties of arrogance and over-specialization, and will soon be circled by other groups who have expanded their fields of professional interest to cover our own.

Second Choice

The second choice, the choice of leadership and growth, appeals to me personally a great deal more. It matches my own interests in education, insofar as I am still learning in this field. The systems function does not operate in a vacuum, and I see the following around me as I evaluate systems problems every day:

Our decades-old relationship with industrial engineering.

The developments in the personnel and industrial relations field which have crowded in on us in the past twenty years.

The teaching of business administration since the second World War in particular, and its inclusion of insights into human relations, communication, and top-management education and decision-making.

The development of operations research, which in the past ten years has almost paralleled our own as an Association, and which is scoring extremely high on acceptance in many quarters.

The emerging field of general system theory, which only began to organize as a group or society three years ago, and which published its first yearbook just last year.

Age of Specialization

Each of these—and there are others—is a developing field, some with intensely active investigational characteristics. Each of them overlaps our own to a greater or lesser extent, and many SPA members have a real interest in one or more of them. They are all going great guns, developing techniques and theoretical structures just as significant as our own electronics and IDP.

Like ourselves, they are developing specialties (and have been for some time). It is an age of specialization. But out of this is coming a hunt for new combinations, and the search for generalizations. I don't think that it will stop with combinations and hybrids. I think that out of all this will come some unifying concepts of great scope and power, some structure of ideas which may well revolutionize our way of looking at ourselves and the world.

Growth and Development

The question of growth and development must take some of these external changes into account. How SPA maintains itself in such an environment will, I think, be a direct result of how well its members manage their own growth, expansion of interests, and development of broader skills.

continued

This is at bottom an educational question. That is why we see education in almost everything we touch in SPA.

SPA can grow by taking into itself some of the new developments, and making them part of itself, just as other fields can take up our techniques and make them their own. Which way it goes will depend upon SPA's view of the scope of the systems function, its scope of activity, and its readiness to explore and lead far out on the frontier.

Counter-Argument

The counter-argument is, of course, that these fields, particularly operations research and general system theory, are beyond most of us; and that anyway, we would be diversifying our efforts to the point of losing our identity, to the point where we wouldn't recognize ourselves. But, as any educator will tell you, these are comments of people who feel they've hit the plateau, who've gone as far as they think they want to, and who don't want to make any more effort at education.

Now, we may have to choose between two main directions. Whether we tread water, or decide to expand to cover some of the developments affecting the systems field, we have a growing country and a growing population of systems men to train, and *either way, SPA has some educating to do.* Businesses are being born, growing, getting more complex every year. The systems job which has to be done is getting bigger and bigger every year. As an Association, we have an obligation professionally to teach, to train our replacements, and help to provide for the many more of us who will be required in the future.

What Are We Teaching?

If we have some educating to do, what are we doing now? Largely, we are teaching the "classical" field of systems education as it exists today. It gives excellent training to new men coming into the field, and provides refresher courses for practicing systems men and business men who use techniques already developed, with important and significant results. I think this is extremely worthwhile; this is probably going to remain close to the core of our teaching for quite a while to come.

But what about the future, under the second of our alternatives?

In my view of the situation, it is likely that the grand alliance, the unification of disciplines or structures or ideas I spoke of, will come through educational efforts. As we hunt for ways of teaching our own specialties, the men doing this hunting will find more and more cross-over between the fields. We're all in the same managerial area, all of us—systems, operations research, management science, business administration, industrial engineering, and the general system theory men. It's fortunate that those engaged in education are in an atmosphere where it is right and proper to develop theoretical structures. Out of that atmosphere will come the hoped-for unification.

Liberal and Technical Education

It is one which should link organization, communication, human relations and interaction, and the technical investigative and evaluative disciplines of systems analysis, operations research, engineering, and a number of others into a coherent, teachable structure of great theoretical range and of considerable practical power.

The end-product of an education based on such a unified view of systems work—and I would still call it systems work, though perhaps I'd have to say that it was general systems work—would be a liberally and technically educated man. Our aim would be to develop the whole systems man, to develop him according to an organized and unified plan, and not just

to splatter him with a number of patched-on techniques. "Know-how" is important, but in time "know-why" will be more important.

Application of General Skill

The specific training of the new systems man would be in analysis, evaluation, creation, and communication of systems. He would have command of the theoretical basis of his work, and of an ability to translate fluently from the theoretical level to the level of practical application and communication of solutions. He would be a stranger to no industry or form of organization, because he would have a fundamental grasp of how people work together, and some knowledge of the general patterns in which they do their work. It would mean, in short, the application of a general skill to human situations where decisions have to be made, regardless of where those situations occur.

What He Would Be

The systems man would have a developed skill and taste for questioning the obvious, as well as the less obvious.

He would have a unitary view of himself and the world around him, and understand the place of his work in relation to the work which others are doing, much as a doctor does.

He would have a sense of balance, and a way of thinking, in dealing with variety and change, and be able to handle differences within similarities as easily as he finds similarities in different situations.

He would have a developed skill at creation—at making new, fruitful combinations of new or old ideas. He will know when to call a halt to creating combinations when it comes time to put them into use.

He would be as proficient as a biologist in relating structure to function, and understanding the modifying influence of function on structure; and he would understand from many different aspects where the limits of these influences lie.

He would remain close professionally to developments in other fields related to his, and would not lose his generalist hearing when it came to listening for original discoveries in other men's societies.

Complex Future

He would, in short, be equipped to meet a pretty complex future. He would have expanded his interests, activities, and scope of training to relate himself in more ways than he does now to the top management he works with, and would prove himself more valuable because of the number of skills he could bring to bear on a given question. He would be given, and be able to handle, the bigger and more challenging problems which will face general management in the future.

SPA is helping to develop this systems man of the future, through its educational program and through its contact with other societies. Colleges and universities can translate this help, by incorporating into their courses some of the training which will help to provide this sort of man for the future.

Must Help Himself

But most of all, the systems man will help himself. Though some of it can be taught, this sort of education is the kind you grow into. It can't be pumped and prodded into you. Unhappily, it is not the sort of thing that can be fully transmitted by the lecture method or by the canned program, regardless of style. This is the education which changes a man down to his roots, and makes him something other than what he was when he started, or even better, takes the right potential man and makes him a professional in the field. Our job is to do the best we know how on both fronts. **s/p/a**

A step by step approach to conversion from manual methods to electronic control

EDPM Inventory Control

by R. D. Benson

► Inventories at the Hanford Atomic Products Operation are managed by the Purchasing and Stores Operation of the Relations and Utilities Operation. The inventory system described here is designed for a general supplies inventory containing about 20,000 items valued at approximately two million dollars. It is comprised of a wide variety of items, e.g., paper clips, safety shoes, nuts and bolts, drums of soap, stainless steel, janitorial supplies, etc., catalogued in 29 sub-classifications. Unit prices range from one mill to hundreds of dollars. Disbursement transactions range from nine to ten thousand per week.

Until recently this inventory was controlled through a 5 x 8 card record system in which each transaction (purchase, receipt, transfer, etc.) required manual posting, calculation and review.

Robert D. Benson is Program Leader—Data Processing, at General Electric Company's Hanford Atomic Products Operation in Richland, Wash.

For a number of years the need for a mechanized form of inventory control had been recognized. The 702 Electronic Data Processing Machine with its high speed, reliability, flexibility and calculating capacity, provided Stores personnel with the ideal tool with which to satisfy this need.

A small study team of Stores and Data Processing Operation personnel was formed and it was through the joint effort of this group that the EDPM system was defined, developed and implemented.

The study group adopted a step by step approach to the conversion from manual methods to EDPM. Rather than disturb the entire Stores Operation in one upheaval, it was thought best to convert the inventory in a series of steps designed to handle one problem at a time. It was hoped, thereby, to eliminate confusion, insure an accurate cutover, and reduce the training problem inherent in a job of this complexity.

The first phase was a parallel operation. Stock issues were keypunched into tabulat-

ing cards. Weekly on the 702, the quantity on each issue was multiplied by the unit price contained on a master tape (one price record for each item in the inventory) to compute the value. A report of issues by stock number was prepared for comparison with results of daily manual posting to 5 x 8 card records.

Unit price changes were computed manually from the posted records and entered into the system as corrections to the pricing master.

In the second phase, daily detail posting of issues was eliminated in favor of weekly summary posting from the EDPM prepared report. At this point, receipts and all other miscellaneous transactions were still posted in detail and unit prices were calculated and posted manually to the records.

The third phase also was a parallel operation. In this step all transactions (receivings, adjustments, transfers, etc.) were keypunched and the EDPM processing was expanded to compute unit prices and maintain a comprehensive stock balance position on each inventory item. During this period, manual card postings continued as before with the results being compared with the weekly reports prepared on the EDPM system.

The final phase in this program was the complete elimination of the card file.

Early in the study, it was recognized that through full utilization of the data processing equipment it would be possible to:

1. Eliminate manual handling of detail, including postings and hand calculations.
2. Develop comprehensive exception reports to eliminate the need for manual review of voluminous detail.
3. Develop an item record containing data which could be easily manipulated to provide special inventory analysis.

With the adoption of these basic objectives, the procedural review moved into the area of output definition. After exploring a great many ideas, it was determined that the inventory system requirements would be adequately satisfied by three routine reports: One to tell when and how much to order, the second to provide an audit trail, and the third to provide a means of reviewing disbursement history.

The Reorder Analysis (*Figure 1, page 8*) reports each item in the inventory reaching reorder point (when balance on hand plus due-in less quantity back-ordered is less than the lead time plus safety factor multiplied by the average monthly usage).

Two lines of information are printed for each item. The first line corresponds to the columnar headings and identifies the item, its inventory position (balance on hand, due-in, back-order) and suggests a recommended order quantity. The equation $Q = \sqrt{\frac{2PY^{\circ}}{I}}$ is used to develop the recommended order quantity.

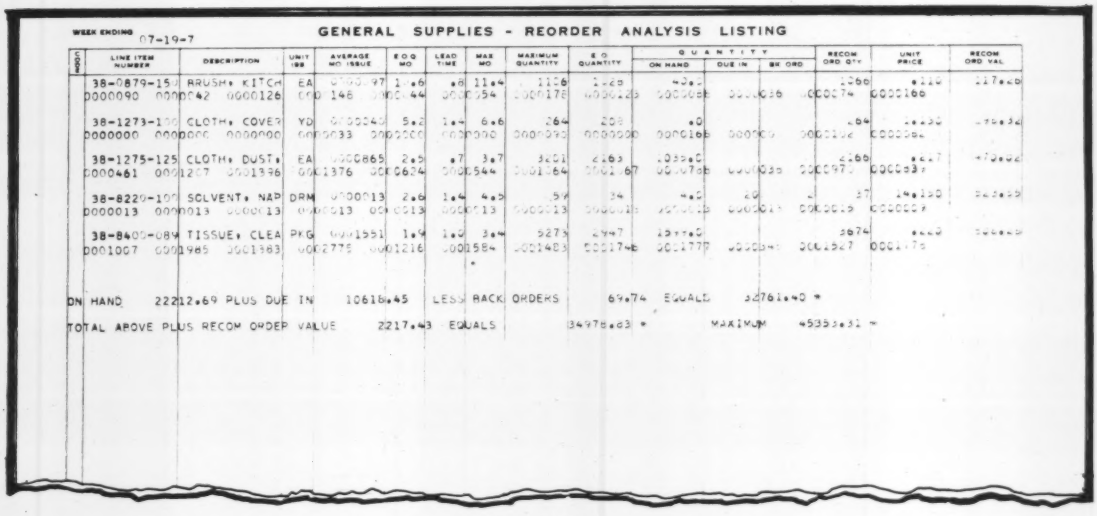
The formula optimizes the costs of inventory that increase as order quantities increase and the costs that decrease as order quantities increase. Increasing costs include interest, obsolescence, storage, etc., while decreasing costs include items such as discounts, freight and procurement costs. (1)

The machine calculates Q whenever there is a change in PY or I. The P and I factors change infrequently. The Y factor,

° where: Q = Economic Order Quantity
P = Cost of Acquisition in dollars per replenishment cycle
Y = Annual Disbursement in dollars
I = Carrying cost percent, per year

(1) The algebraic development of this formula is treated in detail in *Scientific Inventory Control* by W. Evert Welch. Also in *The Theory of Inventory Management* by Thomas M. Whitin.

continued



WEEK ENDING 07-19-7

GENERAL SUPPLIES - REORDER ANALYSIS LISTING

MISC	LINE ITEM NUMBER	DESCRIPTION	UNIT ISS	AVERAGE MO ISSUE	E O Q MO	LEAD TIME	MAX MO	MAXIMUM QUANTITY	E O QUANTITY	QUANTITY ON HAND	QUANTITY DUE IN	QUANTITY BK ORD	RECOM ORD QTY	UNIT PRICE	RECOM ORD VAL
	38-0879-15	BRUSH, KITCH	EA		1.46	.8	11.4	1136	1.46	4.2			1.00	.110	217.43
	0000090	0000742	0000126	CFD	146	.002	44	.0010594	.0001178	.0000288	.0000000	.0000074	.0000100		
	38-1273-100	CLOTH, COVER	YD	.0000243	5.21	1.4	6.6	264	208	.0			.04	.4.30	.172.32
	0000000	0000000	0000000		0000333	.001	2000	.0000990	.0000990	.0000000	.0000165	.0000000	.0000165	.0000984	
	38-1275-125	CLOTH, DUST,	EA	.0000865	2.65	.7	3.7	3.01	.2163	.039.0			.2.66	.4.47	.472.02
	0000461	0001207	0001396		0001376	.001	0624	.0001544	.0001384	.0002.67	.0000788	.0000.38	.0000970	.0000987	
	38-8220-100	SOLVENT, NAP	DRM	.0000013	2.66	1.4	4.6	59	34	.4.0	.20	.1	.37	.14.150	.5.2.29
	0000013	0000013	0000013		0000013	.001	0013	.0000013	.0000013	.0000013	.0000013	.0000013	.0000019	.0000007	
	38-8409-084	TISSUE, CLEA	PKG	.0001551	1.69	1.2	3.64	9273	2947	13.7.0			.3674	.4.4.9	.1.6.4.49
	0001007	0001965	0001383		.0002775	.001	1216	.0001584	.0001483	.0001745	.0001777	.0000840	.0001967	.0001.75	

ON HAND 22212.69 PLUS DUE IN 10618.45 LESS BACK ORDERS 69.74 EQUALS 32761.40 *

TOTAL ABOVE PLUS RECOM ORDER VALUE 2217.43 EQUALS 34978.83 * MAXIMUM 45353.31 *

Figure 1

dollar value of annual usage, changes monthly as the current month field in the master record is moved into the first month previous field. The Y factor is also changed as transactions occur that affect unit price or usage history.

For this reason, Q is recalculated for each item once a month as history is changed, on demand when either the P or I factor is changed, or weekly as an item has activity that affects the Y factor.

Since this report is intended for the guidance of inventory personnel who pass on the advisability of ordering, the second line, a resume of disbursement action for the past twelve months, was included. The historical information was considered desirable in evaluating an order placement situation. Issues history is accumulated in the master record each week in a current month-to-date field. Each month the result is moved into the first month previous field, dropping the twelfth month.

As an item is reported for reorder review, three tabulating cards are prepared. These cards, prepunched with item and class number, unit of issue, and transaction code, accompany the Reorder Analysis report and are used as follows:

Due In (*Figure 2*)

As each item is ordered, the corresponding due-in card, prepunched with the recommended order quantity, is reentered into the system. It sets up the due-in quantity in the master record.

In the event the quantity ordered differs from the recommended quantity, the revised figure is entered in the space provided. This quantity is then keypunched into the same card.

As the transaction is processed on the 702, the program interrogates the revised field first—if not significant, the prepunched field is entered.

Receiving Card (*Figure 3*)

The purchase order number is entered on the receiving card and forwarded to the receiving operation. Upon receipt of the material, the quantity received is entered on the card along with the total value of the shipment. Dollar value is available from a copy of the purchase order. The quantity received is converted to the proper unit of issue and entered in the space provided.

Actual lead time is determined from the date of order placement (available from the purchase order) and the date the

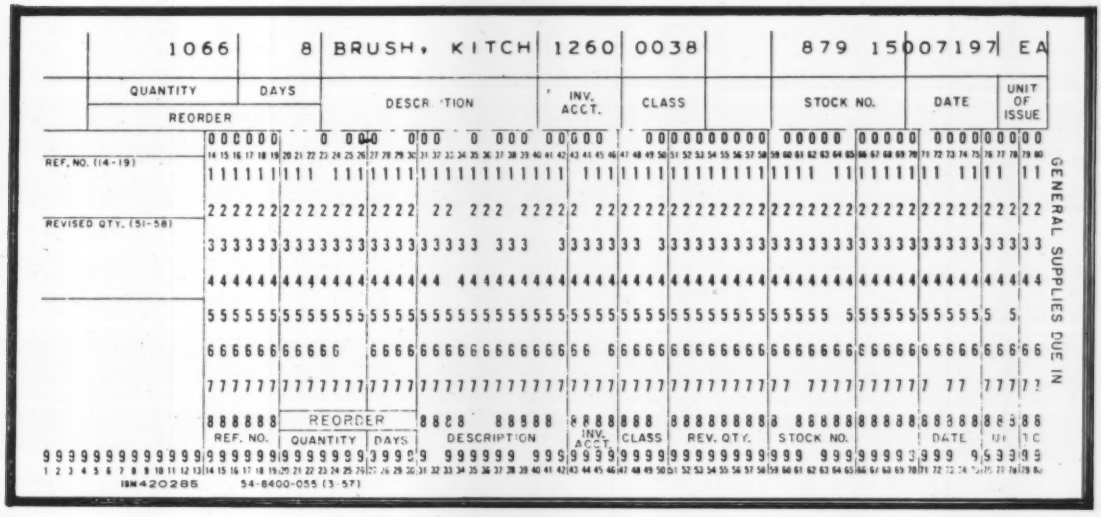


Figure 2

shipment was received. The elapsed time plus an allowance for paperwork processing is entered on the Receiving Card. The recorded information is keypunched into the same card and it is entered in the system.

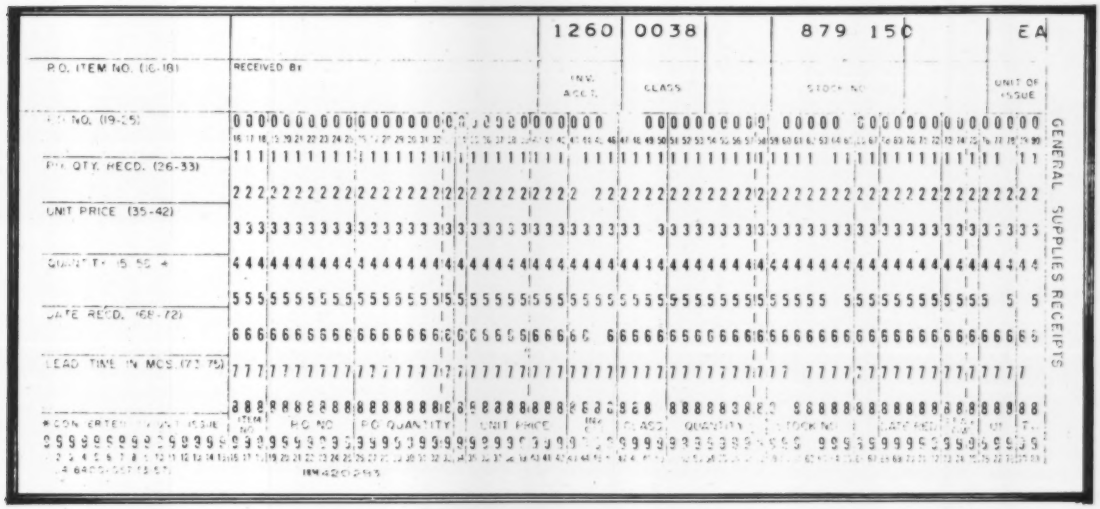
From the receiving transaction, the machine picks up the dollar value of the receipt and the quantity in terms of the unit of issue, computes a new unit price and lead time, reduces the due-in quantity, and computes a new Economical Order Quantity position for the item. The results of these manipulations are recorded in the master record.

On Order Card (*Figure 4, page 10*)

The On Order card is used as a desk reference. It is a handy file of orders outstanding and is destroyed when the order is received.

At this point, it should be mentioned that the machine is programmed to edit

Figure 3



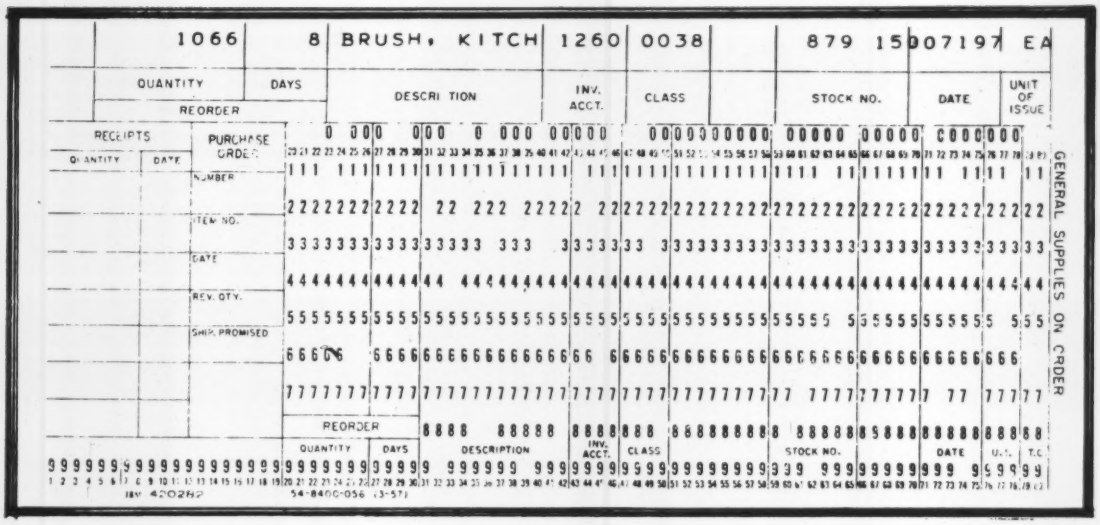


Figure 4

data wherever possible, rejecting and reporting transactions that are in apparent error. If, for example, the due-in quantity set-up for an item is less than the amount indicated on the receiving, the receiving transaction is rejected for additional review. A duplicate receiving may have been created in error; or an incorrect stock number may have been punched into the card; or it may be a legitimate over-shipment for which the additional due-in was not created.

Another check is made on the unit of issue as punched in the receiving card and recorded in the master record. It is surprising how often units of issue are changed between the time of order and receipt.

Impossible situations are also reported —receiving transaction where value or quantity is not reported. This type of editing is applied to all transactions as they are processed. For example, disbursement transactions that would create a negative balance condition are rejected. This is a situation that could be caused by a number of things, incorrect stock number, receiving not processed, etc., all of which require review. The rejected detail is reported out on a printer listing along with a message describing the reason for rejection. EDPM is ideally suited for this type of review. Data purification in this case contributes a great deal to improved inventory accuracy. Disbursing errors, involving units of issue, have been reduced by rejecting transactions where the unit of issue does not match that contained in the master record.

The need to trace error situations dictated the content of a second report, the Activity Listing. (*Figure 5*)

This is a weekly listing showing the opening position of each item in the inventory including date of last activity, balance on hand, due-in, back-ordered, unit price, inventory value, lead time, economical order quantity, average use, and maximum quantity.

The opening position line is followed by detail activity in order of transaction entry, showing the net effect of each transaction on the master record. A closing position line is printed for those items having activity during the reporting cycle.

During the debugging phase and in the initial weeks of the conversion, this report was referred to frequently, to verify the effect of detail activity on the master record. Once it was established that the

program was performing as it should, the report was used as it was originally intended, as an audit trail and an occasional reference source to be used when suspected error situations appear. The date of last activity, carried in the master record and printed in the opening position line, provides Stores personnel with a reference key to the last report on which activity was reported for the item in question.

Because of the importance of issues history to the system (annual dollar value is a factor in the Economical Order Quantity calculation and history is an aid to evaluating a reorder situation), the Demand Analysis report was devised. (*Figure 6, pg. 12*)

This is a two-line report. The first line identifies the item and shows the old and new average usage along with a frequency distribution of the number of issues and quantity for the period being reviewed. The second line presents a recap of disbursement transactions by month for the past year.

Prepared monthly, it presents inventory personnel with a means to review items having unusual activity. Adjustments to master records can be made in those cases where errors have occurred.

It might be of interest to mention at this point that provision is made in the system for substitute transactions. In those cases where an item is substituted for one that is out of stock, it is important not to distort usage history by increasing demand on the substituted item. In such cases, two trans-

Figure 5

WEEK ENDING 07-19-7 — GENERAL SUPPLIES ACTIVITY LISTING

INV	CAPT	STOCK NUMBER	DESCRIPTION	SERV	UNIT	REF NO	LAST ACT TC	UNIT PRICE	LEAD TIME	BACK ORDER	DUE IN	BALANCE ON HAND	INVENTORY VALUE	UOI ADJ	AVE USE FROM	ADJ	EOQ TO	MAX	
1260	38	0750-100	BROOM, WHISK				07-05-7	.473	.7			94.0	44.47	EA		20	11.2	11.9	
				7330	126887		70					2.0-	.95-						
								.473	.7			92.0	43.52	EA		20	11.2	11.9	*
1260	38	0760-075	BRUSH, BOTTL				05-31-7	.150	1.2			129.0	19.35	EA		5	18.0	19.2	
				7533	205283		70					6.0-	.90-						
					NR7709		78					60.0-	9.00-						
								.150	1.2			63.0	9.45	EA		5	18.0	19.2	*
1260	38	0800-090	BRUSH, DUST				07-12-7	1.190	.8			67.0	79.73	EA		51	4.4	5.2	
				7623	204999		70					1.0-	1.19-						
								1.190	.8			66.0	78.54	EA		51	4.4	5.2	*
1260	38	0820-012	BRUSH, CLEAN				05-31-7	11.500	.7			3.0	34.50	EA		1	10.2	10.9	
				6524	205377		70					1.0-	11.50-						
								11.500	.7			2.0	23.00	EA		1	10.2	10.9	*
1260	38	0820-013	BRUSH, CLEAN				05-31-7	7.060	1.5			.0	.00	EA			.0	1.5	
1260	38	0830-125	BRUSH, FINGE				07-05-7	.270	.8			107.0	28.89	EA		13	18.0	18.8	
				7533	205283		70					6.0-	1.62-						
				6760	206086		70					1.0-	.27-						
								.270	.8			100.0	27.00	EA		13	18.0	18.8	*
1260	38	0850-115	BRUSH, GONG				07-05-7	.280	1.0			60.0	16.80	EA		16	16.3	17.3	
1260	38	0879-150	BRUSH, KITCH				07-12-7	.110	.8			130.0	14.30	EA		97	10.6	11.4	
				6830	205855		70					12.0-	1.32-						
				5520	205710		70					12.0-	1.32-						
				5560	206037		70					36.0-	3.96-						
				7533	205283		70					6.0-	.66-						
				5760	205698		70					24.0-	2.64-						
								.110	.8			40.0	4.40	EA		97	10.6	11.4	*
1260	38	0910-100	BRUSH, POLIS				05-31-7	13.500	1.1			2.0	27.00	EA			.0	1.1	
1260	38	0925-010	BRUSH, RADIA				07-12-7	.490	1.4			89.0	43.61	EA		19	11.3	12.7	
				7623	204999		70					1.0-	.49-						
								.490	1.4			88.0	43.12	EA		19	11.3	12.7	*
1260	38	0930-005	BRUSH, SCRUB				05-31-7	8.350	1.1			2.7	22.55	SET		1	12.0	13.1	

continued

action cards are created. One entered for the item disbursed, reduces the balance on hand but does not increase usage history. The second card entered for the out of stock item, adds quantity to the usage history field, but does not affect balance on hand.

The EDPM inventory system is schematically presented in figure 7, on pages 14-15, the circles representing tape input and output units. Output units are to the right, input to the left.

The record developed for this procedure contains 430 characters of inventory data, dictated largely by reporting requirements. On tape each record is slightly larger than two inches. The entire 20,000 item inventory can be stored on 1½ reels of magnetic tape. By comparison, the same number of manual records, housed in six banks of tray type cabinets required about 300 square feet of floor space.

All detail transactions are keypunched into tabulating cards from source documents, after which, in an auxiliary operation, they are recorded on tape, one record at a time. These records are sorted into stock number and transaction code sequence.

Transaction codes identify the transaction and record format and establish the order of entry for processing against each individual master record. Approximately 60 transactions are required. This includes

Figure 6

WEEK ENDING 07-19-7 — GENERAL SUPPLIES — DEMAND ANALYSIS

LINE ITEM NUMBER	UNIT PRICE	AVERAGE LAST	USAGE NEW	TOTAL NO.	TOTAL QTY.	1 TO 9 NO.	1 TO 9 QTY.	10 TO 99 NO.	10 TO 99 QTY.	100 TO 999 NO.	100 TO 999 QTY.	1000 AND OVER NO.	1000 AND OVER QTY.
38-0200-200	.140	93	90	2	36			2	36				
0000178	0000121	0000145	0000040	0000052	0000078	0000073		0000137	0000000	0000108	0000115		0000036
38-0550-125	2.280	110	89	1	50			1	50				
0000424	0000162	0000078	0000109	0000015	0000072	0000042		0000080	0000001	0000003	0000033		0000050
38-0710-015	.990	31	29	3	30	1	6	2	24				
0000074	0000016	0000016	0000032	0000019	0000018	0000078		0000039	0000000	0000015	0000012		0000030
38-0730-180	3.080	17	16	1	2	1	2						
0000008	0000000	0000003	0000006	0000006	0000039	0000035		0000020	0000001	0000028	0000046		0000002
38-0730-240	4.905	52	51	4	43	2	7	2	36				
0000012	0000039	0000127	0000065	0000049	0000044	0000088		0000044	0000010	0000056	0000035		0000043
38-0730-360	6.360	5	5	1	6	1	6						
0000012	0000005	0000000	0000000	0000000	0000006	0000010		0000005	0000002	0000008	0000007		0000006
38-0750-100	.473	21	20	2	4	2	4						
0000048	0000025	0000010	0000000	0000004	0000027	0000031		0000016	0000002	0000024	0000044		0000004
38-0760-075	.150	5	6	1	6	1	6						
0000042	0000000	0000000	0000002	0000000	0000007	0000000		0000012	0000000	0000000	0000000		0000006
38-0800-090	1.190	51	50	5	28	4	16	1	12				
0000028	0000030	0000055	0000087	0000025	0000112	0000037		0000094	0000014	0000050	0000044		0000028
38-0820-012	11.500	1	1	1	1	1	1						
0000000	0000000	0000004	0000002	0000002	0000002	0000000		0000002	0000000	0000001	0000000		0000001
38-0830-125	.270	13	12	3	11	3	11						
0000011	0000026	0000013	0000002	0000007	0000005	0000018		0000017	0000000	0000019	0000013		0000011
38-0850-115	.280	16	17	1	6	1	6						
0000061	0000006	0000000	0000014	0000022	0000004	0000036		0000000	0000012	0000024	0000014		0000006
38-0879-150	.110	97	103	11	156	4	24	7	132				
0000042	0000126	0000148	0000044	0000054	0000178	0000123		0000088	0000036	0000074	0000166		0000156
38-0925-010	.490	19	14	3	14	2	2	1	12				
0000000	0000006	0000042	0000030	0000001	0000018	0000015		0000015	0000006	0000017	0000000		0000014

the master creation and file maintenance type of transactions needed to correct specific fields in the master record (unit of issue, history, back order, etc.), as well as routine disbursing and receiving transactions.

The move from a manual system to one that replaces visual records with a magnetic tape was taken with some caution. The first step included program debugging to be reasonably certain that the system was doing the job.

This was followed by an intensive period of parallel operation, where two inventory classes were processed using both the manual and EDPM procedures. The results were compared, and after one month it was concluded that the EDPM system was doing all it was supposed to—and it was doing it much more accurately.

Even so, a single cycle of proofing was not considered to be an adequate safeguard against future errors. Protection was needed against isolated undetected machine or program errors that either alter records in error or, in fact, lose records completely.

A relatively simple internal machine control was developed as follows:

The input and output master tapes are created with control records following each inventory class—there are about 29 classes in the inventory. Each time an input master record is read into memory, control totals are accumulated from selected fields. Further, as detail transactions are read into memory that affect the selected fields, the net change is accumulated in a separate group of "counters." Also, as the updated master is written, the same selected fields accumulate in a third set of "counters." When a control break is reached, the accumulated input master totals are compared to the input master control record—these totals should agree. Next, the net result of the detailed transactions are added to the master input totals and the result compared to the accumulated output master totals. These totals should also agree—they become the new control record which is written onto the output master tape.

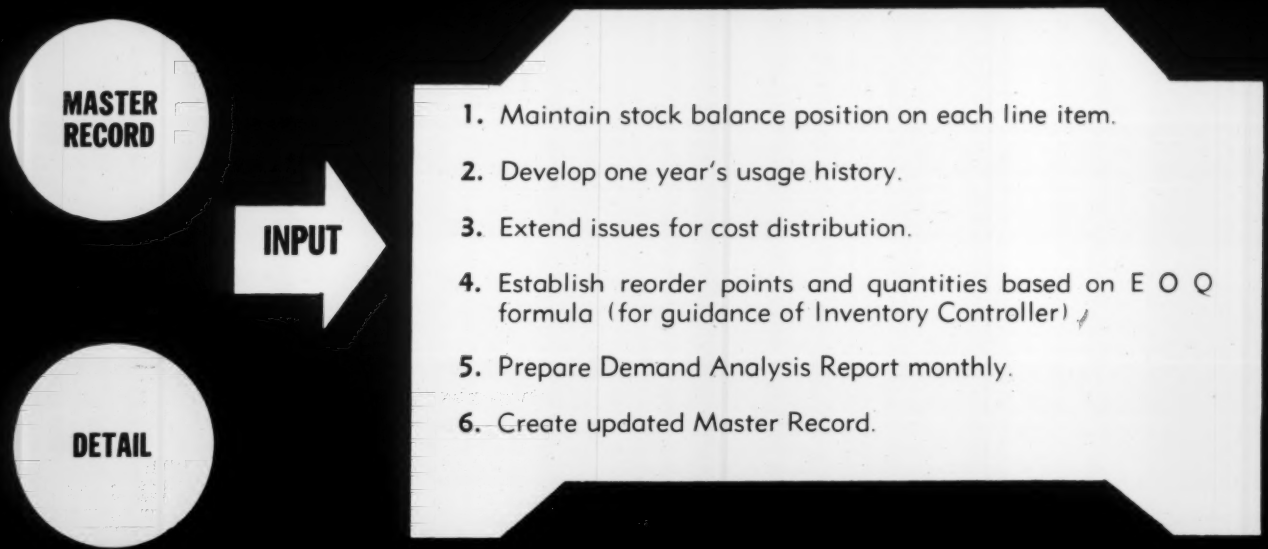
One additional precaution is taken to assure that what is intended to be written on the output master tape, is actually recorded. In a separate editing pass that runs about 15 minutes, the updated master tape is read and the selected fields are accumulated and balanced to the control records. In this manner the input master to the next reporting cycle is proved accurate.

The accumulated control totals are printed by the machine as the comparisons are made. The results are maintained by control personnel who add one more check to the system by comparing beginning and ending totals from the preceding report period.

In the ideal EDPM planning situation, all programs would be completely debugged on test data and results verified to the point where the actual conversion to production data becomes routine and uneventful. However, this ideal is rarely attained—and the more complex the problem, the less likely a perfect conversion will be realized.

The matter of creating test data alone is a challenging problem and, in a complex commercial data processing application, it is a formidable task requiring a great deal of skill, patience and problem knowledge. For example, the input master record in this system contains about 75 fields of information influenced by some 60 different types of transactions. Each of these transactions when programmed has, in addition to the normal or acceptable program flow, anywhere from one to six different data editing subroutine situations.

Add to this complexity the usual pressure of time and one can, when the time comes to use real data, reasonably expect to uncover the normal complement of errors.

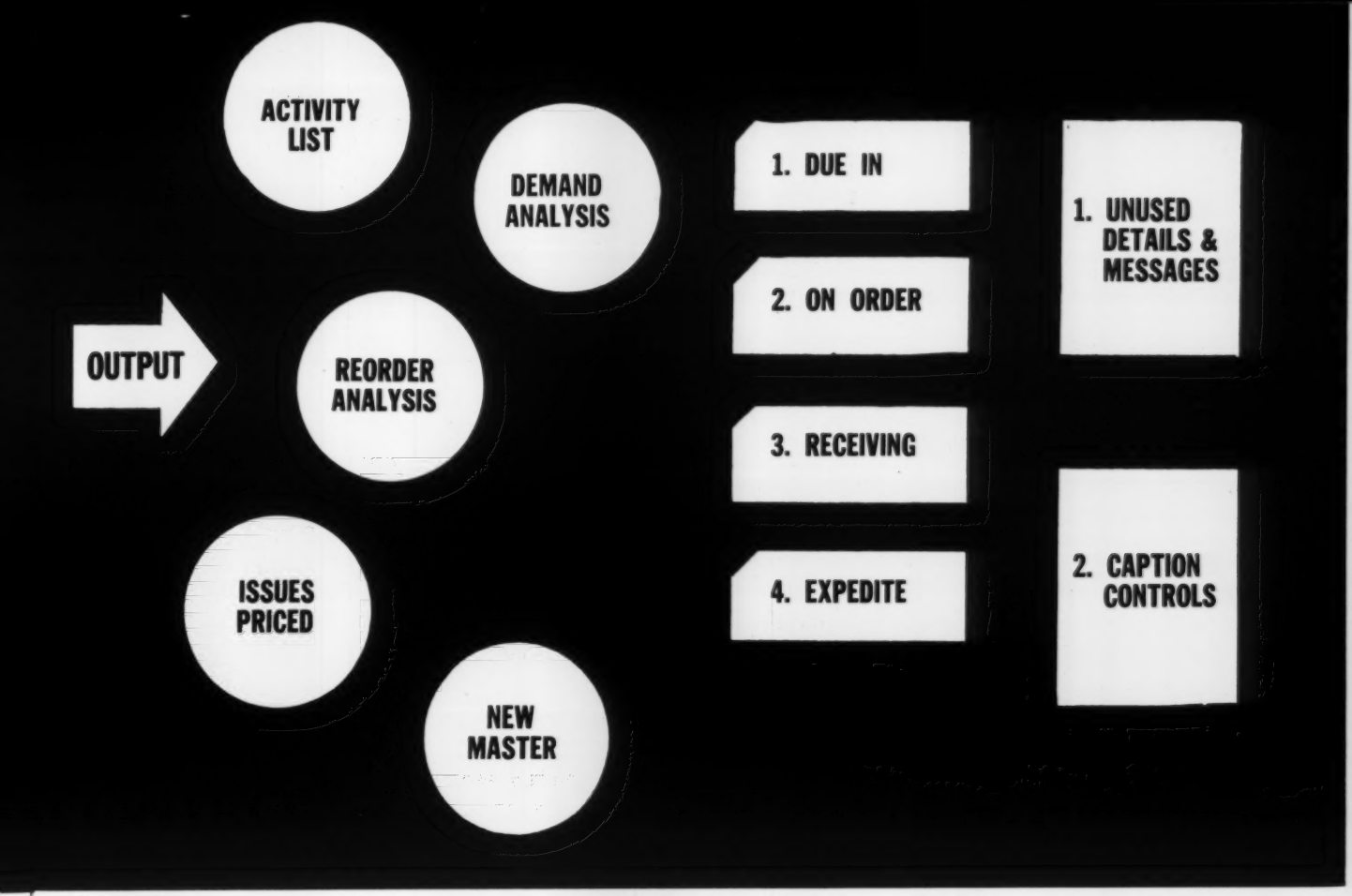

MASTER RECORD
DETAIL
INPUT
1. Maintain stock balance position on each line item.
2. Develop one year's usage history.
3. Extend issues for cost distribution.
4. Establish reorder points and quantities based on E O Q formula (for guidance of Inventory Controller).
5. Prepare Demand Analysis Report monthly.
6. Create updated Master Record.

On the very first run, class control totals previously mentioned were printed along with a message pointing out that the controls were out of balance. This happened during debugging sessions and resulted from programming errors. However, these mistakes had been corrected. It was necessary to resort to a step by step program review until the mistake was identified. An error in logic caused a "lost" master record each time an unmatched detail was processed. The machine did not stop, but continued processing the input, periodically printing out-of-balance control records. This is the type of error that, if not detected, creeps through to the next reporting cycle where conditions become intolerable. In this case, however, the error was detected, the program corrected and the pass restarted with satisfactory results.

EDP requires precise problem definition, and a great deal of attention to detail is required to communicate problem requirements, such as record formats, to operating personnel. Misunderstandings in this area can result in improper data being introduced into the system.

Often, input errors are detected at the console when error messages point out the problem. A certain amount of this is normal; but frequently, and this almost always happens during a conversation, sheer volume makes it necessary to halt, and at this point everything possible is done to get the program back on the track.

There is also the type of input error that is undetected during processing and is not recognized until final reports are printed. In one case, a misunderstood keypunch instruction caused the dollar value of all receipts to be punched one column off. This distorted the unit price, inventory value and Economical Order Quantity position for each item affected. To correct the error, inventory master adjustment



transactions were entered the following week.

In addition to logic and data miscues, there is a variety of overlooked detail that usually crops up to cause some discomfort. For example, it was not anticipated that on a few low value items the computed Economical Order Quantity would exceed 99 months. In each case, this caused an overflow resulting in a machine stop. The reason for the stop was traced back through the program flow chart and symbolic listing, a step at a time. Once the cause was uncovered, the problem was remedied by a minor program change. In this case, a test on limits was inserted in the program.

Actually, the errors that can be made are limitless and are mentioned only to throw a little light on conversion activities.

The program phase of the EDPM system required approximately 5,000 handwritten instructions and was programmed and debugged in about five man-months. This 20,000 item inventory is processed, excluding auxiliary printing time, in five hours.

The system mechanizes the entire record keeping function and provides management with a formula approach to order quantities.

Finally, a comprehensive item record provides management with the data required to analyze present and proposed practices and policies. It may be in the area of rapid inventory analysis that the most dramatic achievements will be realized. **s/p/a**

The writer wishes to acknowledge the contribution made by the following people in developing the system described in this article: Kendall R. Wright, Wayne W. Lindberg, Ronald G. Pulfer, of the Data Processing Operation, and Vaughn O. Finfrock, Richard L. Carlson, of the Stores Operation.

by C. B. Rhoades

Maintenance Contract -Cancellation- Another Cost Reduction

Aladdin Industries finds office machine service call costs are less than payments for maintenance service contracts

► An article entitled "Which is Cheaper: Service Contracts or Service Calls" prompted the Systems Department at Aladdin Industries to review the service contract costs on office machines at the Nashville office. From this review and a subsequent survey the decision was made to discontinue maintenance contracts on all office equipment. The results: $1,483.62 savings to the Company the first year the program was in effect.

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In evaluating this experiment consideration was given to the construction of modern office machines and their durability. Most machines today are built so well that they will withstand years of use without serious mishap. Therefore, it is profitable for office machine companies to offer an attractive maintenance contract for a very nominal price. It was concluded that the profit normally gained by the office machine companies could be retained by Aladdin if the contracts were cancelled. This was pointed out to management in the recommendation of this experiment.

Prior to cancelling our maintenance contracts a survey of office machines was made to determine the general condition of the equipment, experience with different brands and company policy regarding the purchase of new equipment. It was learned that in most cases when new equipment

was purchased the used machines were not traded but transferred to other departments where they would not be subject to constant use. These used machines serve the purpose and prevented the additional investment in new equipment for departments requiring the use of a machine only at certain times during the month. In as much as the allowance on used equipment is determined by the machine's serial number rather than the condition of the machine itself there appears to be no real reason for periodic checks and service as long as machines operate efficiently.

It was determined that most of the machines in our office were less than five years old except a few adding machines located in departments where their use was infrequent. It was interesting to note that the older machines required the least maintenance.

Included in the recommendation was a system for recording service calls and their cost on cards. Each machine was listed on a separate card which showed in the heading brand name, serial number, location and annual contract cost. During the year as service calls were required a record of date and cost was entered on the card for that particular machine before the service man left the office. When the invoice was received it was compared with the card before being approved for payment.

The schedule on the next page shows a comparison of the contract cost with actual service call cost.

From the schedule it appears that the service calls for electric typewriters might be excessive. Several of these typewriters are located in a transcribing pool and are subject to constant use. However, only one

continued

machine in the transcribing pool had a service call cost in excess of the maintenance contract cost. We experienced no serious delays due to the machine being out of repair.

Our offices are not located in the downtown area but out from town about three miles. Our parking facilities and the accessibility from town make it easy for fast maintenance.

Top management at Aladdin is very pleased with the results of this experiment and wants to continue it. What the results will be in future years remains to be seen. It has however, been pointed out that the first year's success may have been due to proper maintenance over the past years. When this maintenance stops, the machine's life is shortened and will require more service calls. Nevertheless, if certain machines or brands of machines prove that the service call cost is excessive the money saved will be available to replace them as needed. **s/p/a**

Machine	Contract Cost	Actual Repair Cost	Annual Savings
Electric Typewriters	$458.50	$286.80	$171.70
Adding Machines "A"	595.53	58.05	537.47
Payroll Bookkeeping Machine	116.75	-0-	116.75
Calculators "A"	106.00	-0-	106.00
Adding Machines "B"	31.55	-0-	31.55
Calculators "B"	89.92	-0-	89.92
Calculators "C"	41.00	-0-	41.00
Calculators "D"	73.20	-0-	73.20
Calculators "E"	275.00	37.18	237.82
Adding Machine "C"	78.20	-0-	78.20
			$1,483.62

How to establish clerical work standards

Work Measurement in the Office

by Alan J. Levy

► Time standards and incentive systems, commonplace in factories, now are being applied to office operations. The preoccupation of industrial engineers with problems purely derivative from factory production situations and the resistance once offered by administrative personnel to having standards established for their work now are becoming things of the past. The realization that today fully ten percent of the working population is engaged in clerical-administrative functions points up the need for applying work measurement and time study to the clerical areas of industry in order to reap in the office the rewards that measured standards have brought to the factory.

Three primary problems in establishing measured standards in office work make the preparation of work study in the office more difficult than the similar operation in the factory.

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First, there occurs within the normal performance of the clerical operation a greater variety of functions presenting a larger number of occasional or low frequency elements than are to be found in normal factory production situations.

Second, mental elements are common in clerical tasks; i.e. elements in which the operator must make mental calculations or decisions. The time study man must be able to evaluate these mental elements.

Third, the clerical employee will be likely to resist to a greater degree the time study of office procedures than will the factory worker to the study of his operations.

These three problems: greater variety in the elements composing the work situation, the necessity of having to judge another person's thinking; and the greater tact and diplomacy required in handling personal relationships demand that only the best time-study man or industrial engineer perform office studies.

An absolute prerequisite before starting any time studies is the completion of a system study with the introduction of the improvements the study will develop. System improvement not only offers savings, but unless the overall system is properiy de-

continued

signed, engineering time and money may be wasted by increasing the output of operations that prior system study would have revealed as work that should not be performed at all. When the office routine and system is itself in need of considerable therapy, the initial system study may develop into a major project; but if system improvements are not instituted before the first time study is undertaken, studies and rates will not insure the maximum savings. It is quite likely, moreover, that later system improvements will throw out all the results of initial time studies by necessitating new studies at repeated expenses because the changes in the system will require a totally new method.

After the maximum possible savings in system design are established, method improvement and work simplification studies should be made. At this point the analysis of individual operations is initiated which is the first step in the time study procedure. Work simplification should insure that the "one best way" of doing the particular operation has been designed and all necessary changes in the method have been made. These may include the size of and arrangement of the desk, equipment to be used, etc. From these work simplification and method improvement studies, standard conditions for the work will be established. The clerk should be trained in the new method and given time to learn the improved method before the time study itself is undertaken.

With the completion of system and method analysis, time studies themselves should be started; but the introduction of a stop watch must be preceded by an education and selling program that informs the employees and managers why stop watch studies will be taken. It is important to maintain employee confidence and before commencing stop watch studies the clerks should be informed about time study. There is a particular initial resistance to stop watch work in the office and the success of an incentive program will hinge on insuring that the clerical staff understands and is willing to cooperate with studies.

The first step in the actual study is to determine a unit of production that may be measured and easily recorded as the basis of measuring output and paying premiums. This unit may be post one line, or type one page, or file one document, or complete one case, etc. Whatever unit is chosen it must represent the production of the operation and it must be easy to count and record. The unit of measure chosen may not always contain the exact quantity of work from one unit to the next. The work content in clerical operations often varies from one unit to another, and it is common in such cases to use an average quantity of work. Thus a clerk who makes entries on a card may write from one to ten lines per card when the established unit of measure is process one card. The past production should then be analysed statistically and a count of the number of lines posted and cards processed during a sample month made. From this an average number of lines may be computed and this average number of lines per card used in computing the final rate. After the unit of measure is determined the cycle should be divided into elements that are easy to record and that have definite, recognizable break points, and preferably that run from .06 to .20 minutes each.

When making the actual study it is of utmost importance to rate every element at each observation. This ensures that the maximum will be obtained from each reading and assures an evaluation of the reading. In office operations many low frequency elements usually exist, i.e.: elements that are only occasionally performed, such as check name in register, answer telephone, open new account card, sharpen pencil, etc. Readings on these elements are only useful if they have been rated, and

Study No: 14-2 Observed by: A.J.L. Page 1 of 10

Operation: Post Repair Notice to Maintenance Ledger Date: Jan. 7, 1957

Dept: Maintenance Study Time: 75.44 Time Start: 9:04 AM

Operator: N. Cohen Ineff. Time: 3.22 Time Stop: 10.23

Equipment: Desk - Visible File Obs. Time: 78.76 Elps. Time: 79 min.

ELEMENTS	R	T	D	R	T	D	R	T	D	R	T	D
1. Away Notice Position, New Notice		Ⓐ		70	20	07✓	95	94	05✓	95	12	05✓
2. Read Card, Ver. Signif. - Sub. Time	75	46	13✓	80	32	12✓	100	2:03	09✓	100	20	08✓
3. Search Machine Card, Find Pos.	75	62	16✓	95	45	13✓	95	17	14✓	90	35	15✓
4. Enter Date & Job No.	80	71	09✓	90	53	08✓	95	24	07✓	95	66Ⓒ	07✓
5. Enter Description & Remarks	80	91	20✓	85	70	17✓	90	40Ⓑ	16✓	95	79	13✓
6. Enter Material & Time	80	1:01	10✓	85	79	09✓	lost	97	16✓	90	87	08✓
7. Initial Slip - Away Card	80	13	12✓	90	89	10✓	95	3:07	10✓	95	96	09✓
Ⓐ Assort Papers before Starting	80	33	33✓									
Ⓑ Answer Telephone							75	81	41✓			
Ⓒ Open New Mach. Card										70	59	.24✓

Remarks: Procedure and layout detailed on study 14-1

TIME STUDY SHEET

Figure 1

thus the particular reading adjusted against a standard. Because of the many low frequency elements present, longer studies are usually needed for clerical operations. It is also important to take readings at different times during the day to ensure that every aspect of the work has been observed and recorded. Both the employee and supervisor should be questioned to determine whether or not all the operations or normal interruptions have been observed to find what additional elements should be included in the final standard.

To be sure that all elements are rated and all low frequency elements are recorded, a Time Study sheet should be used which gives a column for rating for each column of times. Figure 1 shows a recommended study sheet. Each element is individually recorded, rated and the time entered. There is a blank column to the right for time differences if continuous readings are used. The column may also be used to check off each reading when they are abstracted to an analysis sheet. When many low frequency elements are present, it may be

continued

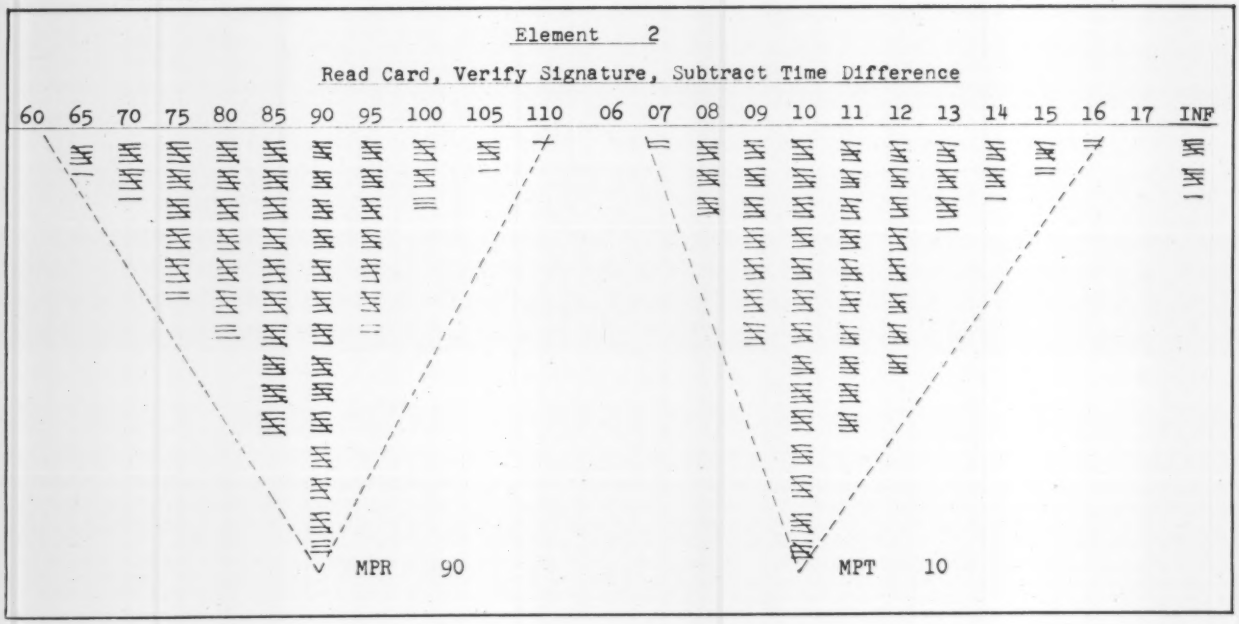
Element 2
Read Card, Verify Signature, Subtract Time Difference
60 65 70 75 80 85 90 95 100 105 110 06 07 08 09 10 11 12 13 14 15 16 17 INF
MPR 90
MPT 10

Figure 2

desirable to use a study sheet that gives an individual line for each element. Studies made with such sheets require many pages and the study man should number his pages properly. He should also use a shorthand notation in recording the elements for he will not have enough time to write long descriptions. Any appropriate set of symbols will do. It is only important that their meaning be properly detailed once in the study so that they will be understood at a later review or audit. A sketch of the work set up should be drawn on the back of the first sheet with a list of the standard conditions for the study. At the completion of the study work the readings are abstracted to analysis sheets where they are plotted in probability triangles one for time and one for rating to obtain the Most Probable Time and the Most Probable Ratings. (See example of element "Read Card, Verify Signature, Subtract Time Difference," Figure 2.) Those low frequency elements that do not contain enough readings to plot individual triangles may be grouped together in one probability triangle or computed mathematically by using an average of the net times. Finally, on a study summary sheet, Figure 3, the net time is determined, rest factor is added, the time is adjusted for frequency and from this the final rate is computed.

Rating Mental Operations

It is recommended every element be rated, including those elements that are wholly or partially thinking; that is, elements where the clerk must read some information and decide what to do. The study man should be stationed so that he can see and read the document or sheet. He must completely understand the operation so that he understands what is being looked for, what are the mental operations involved, what choices are available to the operator, and what the operator should finally do. A thorough understanding of the operation, and thus the mental processes, leaves the experienced study-man in a position to rate these operations. Thinking can only be rated when the thinking process itself is clearly understood.

In addition to these main recommendations in office time study work all the standard time techniques and procedure should be followed.

The study man constantly must keep in mind the human relations problem and be aware of the extra tact that is needed with office personnel, particularly as studies often take a long time to complete.

To illustrate the above principles the clerical operation "Posting Repair Notice to Machine Ledger" will be described. This clerical operation consists of posting to a machine ledger card the information recorded on completed repair notices. The repair notices are filled in by maintenance personnel when they repair factory equipment. In this operation the mechanic is given a repair notice that has a job number, and a description of the repair that should be completed on a particular machine. The mechanic enters the date he performed the work with a description of the work he actually performed, which may be different than the original estimate. He records his time on and off the job and material used.

The clerk's job is posting the information from the notice to a machine ledger. This is a typical posting operation, similar to posting sales orders to an account control card, or posting invoices to a customer ledger or any of the endless variations of this operation.

The maintenance system had been studied and changed before this posting operation itself was analysed. After method

STUDY SUMMARY SHEET

POSTING REPAIR NOTICE TO MAINTENANCE LEDGER

	ELEMENTS	MPR	MPT	NET	REST FACT.	S.M.'s	FREQ.	FINAL S.M.'s
1	Away Notice, Position New Notice	95	.05	.048	1.10	.052	1/1	.052
2	Read Card, Verify Signature, Sub. Time	90	.10	.090	1.17	.105	1/1	.105
3	Search Machine Card, Find, Position	90	.14	.126	1.15	.145	1/1	.145
4	Enter Date and Job No.	95	.07	.067	1.15	.077	1/1	.077
5	Enter Description and Remarks	85	.16	.014	1.16	.016	1/1	.016
6	Enter Material and Time	90	.08	.072	1.15	.083	1/1	.083
7	Initial Slip - Away Machine Card	95	.10	.095	1.12	.106	1/1	.106
8	Low Frequency Elements	80	.37	.296	1.13	.334	15/258	.019
								.603

LOW FREQUENCY ELEMENTS — Ineffective = 11

4 - Answer Telephone
3 - Answer Mechanics Questions
2 - Sharpen Pencil
1 - Assort Papers before starting operation
1 - Open new card, old card filled
1 - Ask Foreman a question
1 - Repair error or wrong Job No.
1 - File posted Repair Notices
1 - Fill in time sheet

15

Figure 3

continued

improvement, which included substituting a visible filing system to increase the speed in finding the machine cards and standardizing the desk arrangement, the time study itself was undertaken.

The unit of measure chosen was "Post One Notice." Since each repair job was recorded on a separate slip, each slip represented one posting to a machine ledger. In this maintenance system an in and out check on notices is maintained by production control. Production control individually bundles each day's completed notices recording date and quantity of finished notices. The posting clerk notes his time on and off this clerical operation against the particular day's notices he has posted. The payroll department may check the quantity he records posted against the production control ledger to verify the clerk's work. Thus a count of the number of items posted is easy to obtain, and the number of postings verified against the production control book.

Three different studies were taken of the operation on three successive days to avoid tiring the operator and to see if results from different days would fall in the same pattern as shown on the most probable time graph, Figure 2. The time study sheet, Figure 1, had space for the seven regular elements and room to record other items. All elements were individually rated; as continuous timing was used, the time differences were later subtracted and recorded on the sheet. The rating scale used here was 75 normal and 100 standard.

Three of the elements contained mental operations, where the operator read the notice or card or where he performed mental arithmetic. In element 2 he read the notice to see if it was signed and properly filled out and then subtracted the time difference. The observer read these items with him taking care to see if the notice is easy to read. Thus the time study man knew if squinting and prolonged concentration is derived from difficult reading of poor writing, or is acting to obtain a high standard time. The observer also did the subtraction so that he could rate the elment as it was performed. In element 3, the operator pulls out a visible tray and searches for the card. Here the observer must with his eyes also search for the card to rate the effectiveness in finding the particular ledger. In element 5 the operator not only reads the description of work recorded by the mechanic, but decides how it should be interpreted by the clerk and how long it should take to check and rephrase the mechanic's wording into a notation for the card. Elements 4 and 6 are direct copying by the clerk while elements 1 and 7 are routine movements and do not present a difficult rating problem.

In this study there were a total of 15 elements outside the regular cycle; Figure 1 shows the recording of three of these elements. Clerical operations, even when standardized, contain more interruptions than are found in routine factory operations. Elements, such as answer telephone, answer or ask questions, or open new cards are common. Each element must be observed and rated. All low frequency elements may then be plotted on one probability diagram, and if no pattern is obtainable, an average of their net times should be used.

Once the study work is completed, the rest is routine analysis of the data. Probability triangles should be plotted (Figure 2) and the results transferred to study summary sheets (Figure 3). On the summary sheet, the final standard minute value is computed. It is this value that will be used in scheduling work, establishing personnel complement and paying incentive bonuses. With a measured standard the rule of thumb estimates of how much work should be produced by the clerical administrative staff will disappear and in its place will be standards, a basis of effective management. **s/p/a**

Book Reviews

Office Equipment: Buy or Rent? *by Dr. Robert N. Anthony and Samuel Schwartz Management Analysis Center, Inc., 275 Newbury Street, Boston 16, Mass. 104 pp., $15.00.*

"Office Equipment: Buy or Rent?" presents in capsule form the factors to be considered when buying or renting office equipment. As the authors state, "The problem discussed in this book is: Having decided to acquire a piece of office equipment, should you acquire it by outright purchase or by rental? This problem is essentially one of investment policy, and like any investment problem the basic issue is whether the rental and other costs that are saved when funds are invested in equipment will be large enough to constitute an adequate return on the investment."

The essential quantitative factors to be considered in a buy vs. rent problem are: (1.) the earnings rate which they require on investments of the type under consideration, (2.) the estimated useful life of the equipment, and (3.) the cost involved in buying and in renting.

Besides the basic purchase or rental cost there are several other costs to be considered, such as excise taxes, maintenance and service costs, installation costs, salvage value, and miscellaneous items.

The effect on income tax is adequately covered in a separate chapter. The "short cut method of analysis" and the "detailed methods of analysis" are also fully explained in separate chapters.

The book has many charts, illustrations, graphs, and sample calculations to put the thoughts across and aid the analyst in his analysis on whether to buy or rent.

This book is a handy reference whenever tabulating equipment, micro-film equipment or other machines are being bought.

Digital Computer Programming, *by D. D. McCracken, John Wiley & Sons Inc., 440–4th Avenue, New York 16, N. Y.; 253 pp., $7.75.*

The mystery surrounding the programming for electronic computers is gradually dissipated as more books like the "Digital Computer Programming" appear. This book is another one in a series written by General Electric authors for the advancement of engineering practice.

Using a mythical computer called TYDAC, the authors cover the various phases required to prepare a program. In doing so they present the fundamental ideas of programming with detailed examples and illustrations. The book is written essentially for beginners in programming, although it should also be helpful to junior programmers.

The eighteen chapters cover such areas as coding fundamentals, binary and octal number systems, flow charting, subroutines, program checkout, etc. It does a good job in bringing the novice along on the subject of programming from the basic principles of a computer to the techniques for preparing and checking a completed program.

Charts and illustrations are used very freely. Each chapter also has a number of programs which the reader can work out to develop his skill and ability. The appendix includes a summary of TYDAC instructions, octal–decimal conversion tables and a bibliography.

In a manner that one can easily understand, each chapter covers in great detail with ample examples, the methods to be followed in developing the parts of a program for a computer. If a potential programmer were to read this book before he specialized on the programming techniques for a specific type of computer, he would find it easier to understand the machine and the methods for solving problems on it. It should help reduce the training time needed to develop a programmer.

Part I of a three part article which discusses the importance of selecting the proper language in communication

Talking Ourselves into

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► It is important first to state that the absence of communication easily leads to misunderstandings and strained relations among personnel in an organization. The vacuum created mitigates against group-belongingness, cooperation and motivation. Moreover, many fancied notions rooted in the emotions of men are triggered into activity. We have, then, communication crises when we fail to communicate with others.

There are still other misunderstandings created by the evaluations and language choices of message senders. When our words do not correspond to life facts, when they are highly ego-centered, or when they strike a blow at the listener's need for self-respect, we open the way for our second class of man-made crises.

Upon reflection most of us come to the realization that the process of communication is more complicated than we customarily assume. In message sending we have the speaker and his particular frame of reference, and the listener who often has a markedly different perception of the situation referred to in the message. These factors are recognized in this operational definition of communication expressed as a question: *Who says what—to whom*—and *to what effect?* In an ideal situation we expect our listener to say, "I can *hear* you, I *understand* you, I *accept* what you say as correct and proper, and my *behavior* will be controlled by your message." If there is a breakdown at any of these four levels we say commonly that communication has failed. When this occurs we usually attempt to achieve better results by more communication—restatements, explanations, more reasoning and verbal proofs.

A second point of view on communication failure should also be mentioned. "It assumes," says Fritz J. Roethlisberger, "that communication has failed when B [the receiver] does not feel free to express his feelings to A [the sender] because B fears they will not be accepted by A." This position makes communication a two-directional affair since participative action on the part of the listener is invited.

The fact that there are more than 600,000 words in the unabridged dictionary plus perhaps 150,000 additional technical terms suggests that we have a sufficient

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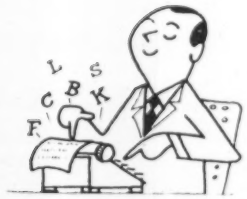

by Prof. William Sattler

o Communication Crises

number of words with which to express our meanings. This however is deceiving because the world of reality is ever changing. With the exception of newly coined technical terms and occasional further additions, we are committed to a fairly stable vocabulary. We have what might be called a finite number of words to represent an infinity of external conditions. In this sense man is blocked by the very nature of a vocabulary. What is more, words are a kind of shadow world since they merely are indicators, signs or pointers. When the connection between words and events is not clear to either party to a conversation, shadow representation appears distorted to at least one person, and conflict is likely to ensue.

There are still greater problems facing us. Suppose a sales manager tells one of his salesmen, "I am shocked by what you have done, for you have broken a basic rule of our company by criticizing our competitor's product to a prospective buyer." On what basis did the manager arrive at this verbal output? We have, let us say, the complaint registered by the buyer. We can call this the external situation. Then we have the sensory end organs of the manager that are affected by the light and sound waves emanating from the customer's oral complaint. How much or how little the mana-

continued

ger hears and sees becomes a factor of importance when he listens to the customer. We have also the intellectual interpretations made by the manager, the forces of emotion that affect his interpretations, and finally, the language choices he makes when he talks to his salesman.

What the manager says may or may not be an accurate depiction of the customer's statement, not to mention the possible distortion which the customer is capable of producing. The point is that the customer's statement as well as the manager's verbalization may be colored by feelings. When we talk, ostensibly we talk about a situation, an occurrence, a person, but as humans, we also talk about ourselves. For example, whether we call Executive X *firm, obstinate,* or *pig-headed* may depend more upon our feelings toward Executive X than on X himself.

Two types of input are thus operative when we verbalize: the situation external to the speaker and the speaker's special interests, feelings and prejudices. In the form of an analogy, Francis Bacon spoke of Idols of the Tribe by saying, "The human understanding is like a false mirror, which, receiving rays irregularly, distorts and colors the nature of things by mingling its own nature with it." Coupled with errors in observing and interpreting which Bacon considered as common to everyone, we must add also the so-called Idols of the Cave that encompass each person's private interests, education and emotions. These give to the world of facts the stamp of the individual. Whether the weather is "hot" or "cold," the view "pretty," or John does "well" or "poorly" are conditioned by the observer's electro-chemical bodily states. In brief, then, we tend to project our feelings into what we say—"reports" and reality may therefore be out of alignment. **s/p/a**

Next Issue: Part II—*Language Habits That Create Communication Crises.*

NO. 12 OF A SERIES ON A MANAGER'S STAKE IN SYSTEMS

"non compliance"

by Leslie Matthies

► When a new procedure is in the making, systems people take great pains to *coordinate* this new plan. Each division, section, or department head is asked to check the proposal to see how it affects his operation: Will it help to improve your operation? Does it make things harder for you? How? How can we alter this plan to help you? How can we better tie-in your department?

Thus, *coordination* is the process of getting the most for the greatest number of people. It requires great patience on the part of the systems engineer. It requires that he swallow any pride of authorship as he sees procedures draft after draft torn to shreds. He finds it necessary to compromise. Coordination is certainly a democratic process. Every man who has a part to play in the plan also plays a part in its formation.

Finally all are agreed. The big boss signs and the new plan goes into effect.

The new procedure is hardly operating before a dragon rears its ugly head. We call this dragon "non-compliance." One supervisor won't follow the new procedure for reasons known only to himself.

A supervisor who does just as he likes with his operation regardless of the requirements of his fellow supervisors is no team member. And a manager who lets such a supervisor go on defying his specific orders —what kind of manager is he?

A manager must not only get work done, but he must secure coordination. Non-

compliance in an organization reduces that organization to an ineffective mob.

Everybody begins to worry about the other fellow's job and tries to do that other job to the neglect of his own. Some work doesn't get done. Other jobs are done six times over at tremendous cost.

Thus, the organization becomes sick. Seldom does management suspect that a non-compliance attitude is the reason.

The cure? A top manager who makes it clear that once a supervisor has had a crack at a proposed procedure, then that supervisor is to *comply* with its provisions thenceforth. If the supervisor knows that the boss really means this, his non-compliance will cease. Only tolerance of this dangerous attitude allows it to exist at all.

A firm attitude can kill the dragon of non-compliance. **s/p/a**

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New machine cuts square D's inventory records control time

RAMAC at Work

by Willard L. Jerome and Mrs. Loretta Hartford

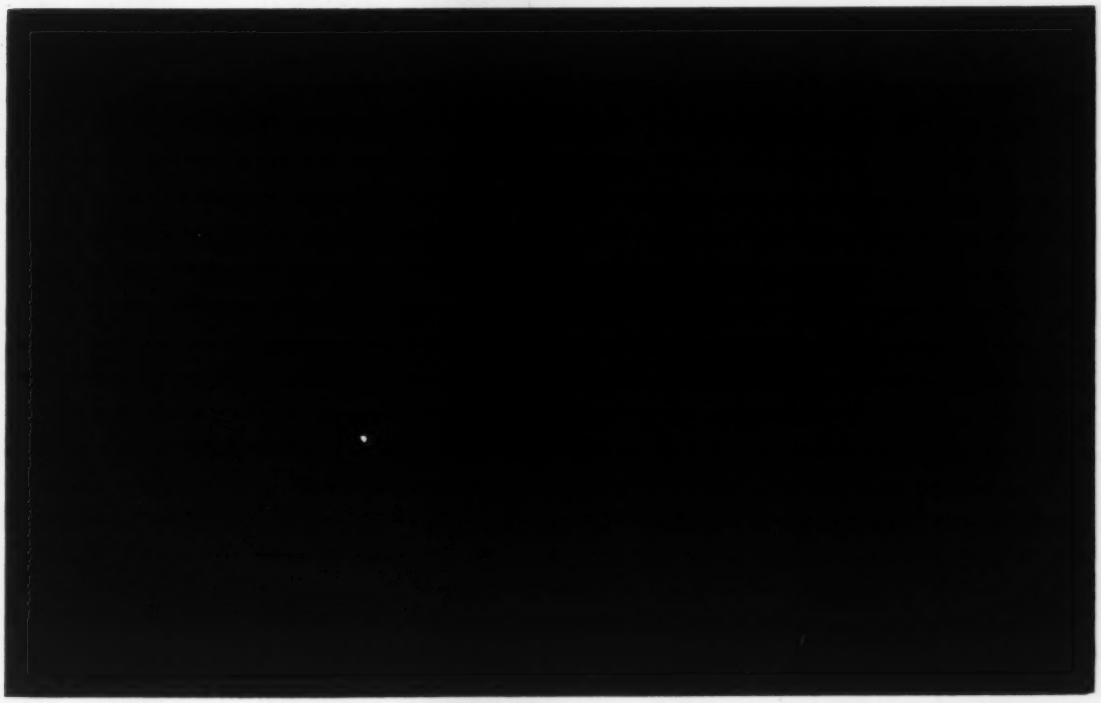
► With a flash of lights and a swish of a searching arm, a new machine can now control Square D's inventory records in a fraction of the time previously required. In contrast to the old tabulating method which took days of batching, sorting, and posting, the new machine can process transactions to completion within seconds. Square D's Industrial Controller Division in Milwaukee now has the new IBM medium sized electronic data processing machine, RAMAC, to maintain its inventory records on 24,000 stock parts.

Willard L. Jerome is Electronic Data Processing Project Director and Mrs. Loretta Hartford is Assistant Director of EDP Projects at Square D Company, Milwaukee, Wis.

With a large random access memory unit accommodating 5,000,000 characters, RAMAC easily stores 50,000 records of 100 characters each, or 100,000 records of 50 characters each. In addition, it will do its own figuring and find its own records. When fed new information by punched cards, it will, by means of stored program instructions, make the necessary computations, find the proper record, update it, print or punch out desired information, and refile the updated record. In addition, RAMAC will at any time, even while processing regular transactions, type out answers to inquiries on the status of any record.

The machine follows its instructions at a speed of 30 milliseconds, or 30 thousandths of a second, per instruction. On the average, it will process, with overlapping of operations, a complete trans-

FIGURE 1. SCHEMATIC DIAGRAM – 305 RAMAC

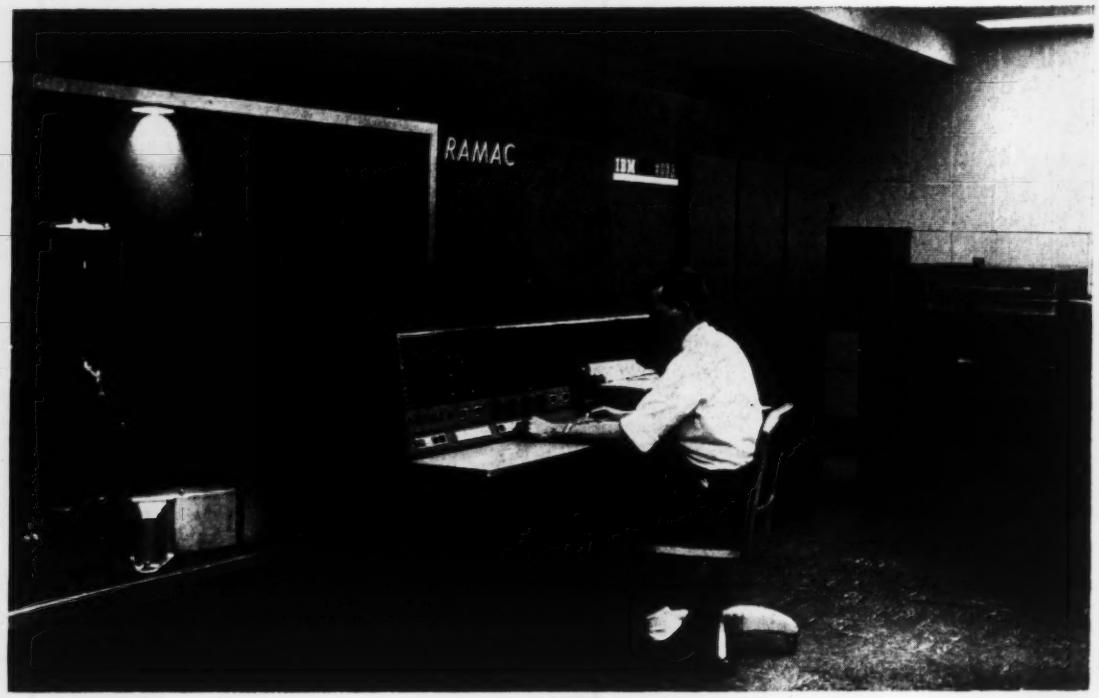


action at Square D Company in approximately 1.6 seconds, or about the time it takes to simply pronounce "1.6". To be able to overlap the operations means that a number of operations, such as feeding, reading, processing, finding a record, updating the record, and printing and punching output information can be done simultaneously, according to the ingenuity of the programmer. Although speed in thousandths of a second may seem slow compared to high-speed scientific computers which compute in millionths of a second, processing speed is balanced with the input and output speeds.

We have given RAMAC a room, 20 by 30 feet. We brought in two 230 volt, single phase, 60 cycle A. C. power lines for the power supply. We also modified the room's acoustics in order to reduce the noise level. Since the machine generates quite a bit of heat, we brought in an air conditioning unit and installed a venting system to exhaust the heat created. We also installed a temperature and humidity recorder which, if the limits under which the machine must be controlled are reached, will ring an alarm bell.

Although the input to RAMAC is punched cards, internally the impulses are transferred from the punched holes to magnetic bits or spots which can be used by the machine for processing and computing at electronic speed. Moreover, the magnetic bits are arranged in a binary code, which is a method of making two numbers do the work of our usual ten numbers. Hence, RAMAC must translate incoming information into the binary code in order to process it, and the outgoing information must be translated back to the card code in order to be punched or printed. As one can see in the middle of the schematic diagram (Figure 1) the processing drum contains the stored program tracks, the working storage tracks,

continued



At Square D Company, RAMAC has its own air-conditioned 20 by 30 foot room with acoustics modified to reduce the noise level.

the arithmetic tracks, the typewriter or inquiry track, the output track and the input track.

The computing, instructing, or updating of records is done on the working storage tracks. Information is transferred to and from the magnetic disk memory shown on the left side of the diagram, by means of the forked access arm, which moves up or down the stack of disks, directly locating the right one. The reading head reads the correct record from the disk and transfers it to a working storage track according to the instruction. There are four working storage tracks which process data by rearranging the data or by assembling information from two or more tracks. For instance, on them the input is computed, the record is updated and rearranged to punch an output card or print a report.

Next to the working storage tracks are the arithmetic tracks. They consist of 10 ten-digit accumulators which are used like adding machines for adding, subtracting, and multiplying.

Next to the arithmetic tracks is the typewriter track. It is used for manual inquiry to the record, and as you see on the diagram, it is the output track for the typewriter. Inquiry may be made at any time to any record and within ten seconds the entire 100-character record will be typed out by the typewriter.

Left of the working storage tracks are the program tracks which contain the instructions for the machine. Each of the 20 program tracks contains 100 digits. Each program step requires 10 positions. Hence the program tracks will store 200 program steps. If more program steps are needed

for an application, they may be put in memory or on unused working storage tracks and brought to the program tracks when needed.

The heart of the machine is the random access magnetic disk memory unit shown on the left side of the diagram. This unit is a stack of 50 aluminum disks, revolving at 1200 revolutions a minute, which are covered with ferrous oxide to make them sensitive to magnetization. There are 100 tracks on each disk, divided into 10 sectors, 5 on each side. The sectors, which are called records, contain 100 characters each. Hence the unit holds 50,000 records.

The access arm has two read-write heads so that either the top or the bottom of any disk may be read at any time. A record in RAMAC is found by means of an address of five digits, made up of three parts. The first two digits are the number of the disk on which the record is located; the second two digits are the number of the track; and the fifth digit is the sector of the track. Thus, if we have a five digit address of 12345, the record is located on disk 12, track 34, and sector 5 of the track.

FIGURE 2

10 DIGIT PROGRAM STEP									
FROM			TO			NO. OF POSITIONS		EXIT	COMP.
TRACK	POSITION (LOW ORDER)		TRACK	POSITION (LOW ORDER)		NO. OF POSITIONS AFFECTED		CONTROL PANEL IMPULSE CODE	COMPARE TEST
X	1	9	W	3	4	0	5	A	

We mentioned earlier the program steps which are stored on the program tracks. A stored program is a set of instructions in code which the machine can interpret and which the machine stores for use when needed. With the stored program steps, or instructions, information is processed by transferring it from one location to another.

In Figure 2 is the make-up of a 10-digit program step. The character in the first position specifies the track on which the data is stored. The next two places specify the location on the track of the data. The next three places similarly specify the position on the track to which the data is to be transferred. For instance, to rearrange information you might want to transfer five characters from positions 15-19 of track X to positions 30-34 of track W. The instruction would be: "from X19 to W34 for 05 characters." The number of characters transferred on one instruction may therefore, range from 100 down to 1.

For reference, each program step is numbered. After executing an instruction, the machine will automatically proceed to the next higher numbered step and will continue to process each step in sequence until interrupted by an instruction to make a decision and transfer to a branch instruction. Decisions are made by testing the setting of various internal relays or switches. The switches may be set by means of impulses from input cards, by results of computations, or manually, according to the application. These switches are decision-making elements and according to the setting, or decision, the machine is impulsed to continue with the processing at one of a number of branch instructions. For example, if the routine is started at step 24 and at step 27 is instructed to make a decision which branches the processing to step 51, the machine will automatically follow steps 24, 25, 26, 27 and then branch to step 51 and continue automatically with steps 52, 53, 54 and so on until it is in-

continued

FIGURE 3

CONTROL PANEL WIRED DECISIONS TO ALTERNATE PROGRAM STEPS	
IMPULSE IN	IMPULSE OUT
ACCUMULATOR SIGNS	PLUS - ZERO - MINUS
ACCUMULATOR OVERFLOW	YES - NO
SELECTORS	NORMAL - TRANSFERRED
CHARACTER SELECTOR	A-Z, 0 9, 11, 12. SPEC CHAR.
BLANK FIELD TEST	YES - NO
COMPARE TEST	YES - NO
ALTERATION SWITCH	NORMAL - TRANSFERRED

structed to make another decision and branch again.

To get the benefit of the machine's decision-making elements, it is necessary to put a character in the ninth position of the instruction step. The presence of a character in this position is the instruction to the machine to make a decision by interrupting the automatic advance to the next higher-numbered step and by emitting an electrical impulse at the corresponding position on the control panel. This impulse can then be wired through the decision-making elements to the correct branch instructions.

Figure 3 shows the decision-making elements under "Impulse In" and the settings under "Impulse Out". In explanation, if correct processing of data varies with the result of a computation, we will test the accumulator sign. There are ten accumulators available, and the result will be in one of the ten. Accumulators work like adding machines and the sign on the result may be either plus, zero, or minus. After the computation is made, the result will be tested by placing (for example) the letter A in the ninth position of an instruction. An impulse will then be available at the A hub on the control panel. This impulse will be wired into the "in" hub for the accumulator being tested. The plus outlet will be wired to a branch program step, the zero outlet will be wired to another branch program step, and the minus outlet will be wired to the third program step.

By the same decision-making possibilities, the accumulator overflow may be either 'yes' or 'no'. Selectors may be either 'normal' or 'transferred'. The character selector may be any letter from A to Z, any number from 0 to 9, or any one of 11 special characters, or blank, so with one instruction, any one of 48 different branches may be reached. The blank field test may be either 'yes' or 'no'. The compare test may be either 'yes' or 'no', and the alteration switch may be either 'normal' or 'transferred'.

Whenever testing the compare unit, a number is added as the tenth position of

the program step. The presence of this number in this position keeps the machine from actually making the transfer as shown by the program step and just sets up the compare unit. The compare unit may then be tested by control panel wiring and the program branched according to the decision.

Square D first heard about RAMAC when IBM offered us the opportunity to field test an engineering model. Because its capacity, speed and mode of access suited our needs so well, we were very happy to accept the field test offer. Its capacity was adequate for our present needs. Since it could permanently maintain 50,000 records on its disks, it could accommodate our 24,000 inventory parts easily, and leave room for other applications as well. It had the right speed for us, too. Since we could fully utilize this machine's time with our present volume of work, the machine would be economically feasible immediately. The biggest advantage, however, was its random access feature. Here was a machine that could take our transactions in any order. We could get away from sorting everything by our cumbersome 17-digit part number.

It was understood that material control would be the first application. This procedure has been done by punched cards for 15 years, with the present system, which is considered very good, in operation for 10 of these years. Before we started programing, we made a detailed flow chart of our present system. So that all the facts would be readily available, we charted every step taken by the normal work flow, as well as every step taken by the exceptions.

When programing began in August 1956, the scope of the application was, to a large extent, already determined. Since the expected delivery date of RAMAC was only three months away, we did not have time to attempt major revision of the present system. Thus, for the field test, we had to limit our scope to the material control procedure being done by tabulating and transfer-posting machines. However, we decided to handle the entire procedure, exceptions as well as normal routine. We also resolved to incorporate any improvements we could.

Once we had defined what the RAMAC material control program was to cover, we faced the problem of an addressing system: how to locate the record in RAMAC. Each location has a 5-digit address: the first 2 denote the disk, the next 2 the track, and the last the sector. There were three possibilities:

1. Use the part number as the address. This is ideal if the part numbers have only 5 digits, or if a mathematical formula can convert the part numbers to a series of 5-digit numbers having no duplicates. Each record is then stored at the address that its part number describes. This was not possible in our case. No mathematical formula could reduce our peculiar 17-digit part numbers to non-repeating 5-digit numbers.

2. Make the RAMAC address a suffix to the normal part number. But if we added 5 more digits to the 17 we already have, we would be devoting 22 columns of each tabulating card just to the part number. We simply did not have the extra columns available.

3. Use an index. Although this is the least direct of the three possibilities, it is the one we had to use. RAMAC first goes to an index, then examines each part number in the index until it finds the correct one. It is as though you knew the block a friend lived on, but not the exact house. You could go to the block and then ring door-bells until you found your friend. This is just what the machine does, except it searches the whole index in 1/50 of a second.

To use the index method, we set aside the 0 sector of each 10-sector track in the magnetic disk memory as an index to the other 9 sectors of that track. Then we reduced our part numbers to 4-digit addresses, showing disk and track locations.

continued

With index addresss, it no longer mattered that we had duplicate 4-digit addresses since on each track, and hence in each index, there is room for up to 9 part numbers. To avoid the extremes of overflowing an index or of leaving an index empty, we juggled different mathematical formulas for reducing our part numbers to 4-digit index addresses until we discovered one that put 7 or 8 part numbers to an index.

Programing

First we determined what types of incoming information, or input, would be fed into the machine. We would have two types of input: (1.) Bill of material decks consisting of a keypunched header card representing the assembly to be manufactured, and pre-punched detail cards representing the components that will be removed from stock to make the assembly; and (2.) Miscellaneous transaction cards key punched to cover situations like order-point increase or decrease, and inventory increase or decrease.

To give you an idea of our material control volume, RAMAC processes about 250 decks and roughly 1000 miscellaneous cards a day.

Next we drew a broad block diagram to show what was to be done with the input:

1. Extend the unit quantity of each component to give the number needed to manufacture a certain number of assemblies.

2. Bring stock status totals up to date.

3. Punch order requests when needed. After up-dating the stock status totals, check whether the order point has been reached. If it has been reached, RAMAC would further check whether an order request has already been issued. If an order request has been issued, RAMAC would check that the quantity requested is still enough to cover the situation. If more parts *are* needed, the order request card punched by RAMAC would show the present status of stock, the quantity to order, whether to purchase or manufacture, and the date we can plan on receiving it.

4. Print a material list showing what component parts are to be drawn from stock to manufacture the assemblies that have been ordered.

5. Reproduce cards for parts controlled outside RAMAC. Certain detail cards in the pre-punched decks are controlled either as finished devices or by the job shop and are outside the material control procedure. In these cases RAMAC would only print the item on the material list and reproduce the input card so that a copy can be sent to the department that does control the item.

6. Control the decks. Each pre-punched deck contains a control number. Actually this control number is the sum of the unit quantities of the detail cards in the deck. In processing the deck, the machine would accumulate the extended quantities of the components. When the deck is finished, it would multiply the control number by the quantity ordered. The two products should be equal. It would check that the entire deck was processed, and that every detail card was extended correctly.

7. Control the documents. In order to insure that every source document actually gets through the machine, they would be assigned control numbers. RAMAC would count the documents and keep a record of the control numbers processed.

8. Assure that certain invalid situations, such as negative order points or stock status totals which don't balance, would never exist in the records in memory. Each time a record is up-dated, a check would be made that no invalid situation has developed. If one did develop, RAMAC would automatically type out the erroneous record for investigation.

This would be our main program. It would do our daily material control work. We then diagramed another pro-

gram called the maintenance program that would do everything else:

1. Load our records in memory and give us a cross reference card showing the exact location of every record.

2. Make any changes necessary in the so-called unchanging part of the record, such as location, order quantity, or lead time. This function would give us a printed report showing the record before and after the change.

3. Delete any records that become obsolete and open the space for re-use.

4. Unload selected records. Inquiry through the typewriter would tell the status of any record, but sometimes we would want to know the status of not just a few, but of a whole list of parts. Instead of inquiring one by one at hand speed, we would feed in cards and RAMAC would unload the records needed.

5. Do a mass unload of the whole file twice a month to provide an audit trail.

After drawing a broad block diagram showing what we wanted the machine to do, and before we went into the detailed program steps, we designed our permanent records, considering the items that must be in the records, the number of positions each item required, and the order in which we wanted the items. Most of the items controlled under our present punched-card system were included:

Part Number

Stock Status Totals:

On Hand Above Requirements
On Order
Order Point
Available Above Order Point

Control Data:

Location in Stockroom
Source (purchased or manufactured)
Order Quantity
Replacement Time
Date Record was Last Changed
Average Monthly Requirements
Requirements Month to Date

Similarly, we designed our working storage tracks.

With our record and track layouts designed, and with a broad block diagram drawn to show what we had to do, we drew a detailed block diagram to show exactly how we could do it—what program steps, for instance, would be necessary to "update the record". With a detailed block diagram to work from, writing the instructions was a simple coding job. We wrote them right on the block diagram.

Although the production models can handle the 200 program steps or instructions we soon wanted to do, our test model can handle only 100 steps. Therefore we had to shift our attention from the accumulation of desired program steps to ways of reducing the number of steps by rearranging them so that many steps would do double duty. In many cases this meant going out to the control panel. Hence, we added control panel functions to the block diagram. We also added a few other things to the diagram like step numbers and restart points.

We were concerned with saving time. Careful analysis of the program showed that by further rearrangement of steps we could make better use of RAMAC's overlapping features. Hence we added timing to the block diagram, which cut the time down to 2.5 seconds a transaction, the application to take under 4 hours a day.

Now our detailed block diagram had everything on it. It was our whole program and we used it constantly—in fact, it soon got so shabby and dog-eared we were afraid it would fall in the waste basket and look as though it belonged there. RAMAC's control panels were wired from it, and it was very valuable when we were testing.

Programing had started in mid-August 1956, and by the end of November we felt we were in some degree ready for RAMAC. But since it was not ready for shipment yet, we used the time to further

continued

revise and improve our program, and prepare our test material.

In January 1957, we went to San Jose, California, to test our program on one of the engineering models being built there. The test showed that our program was basically in excellent shape, but that there were two problem areas in which our concentrated program steps were exceeding the machine's capacity and hence would have to be enlarged a bit.

When we returned, we prepared two additional versions of the program, one basically the same, but eliminating the problem areas, the other using a different approach that had occurred to us. Since this different approach seemed to give us better results, that is the version we used.

Our test model arrived May 15. After installation and testing, we de-bugged our revised program and prepared our records for loading. A preliminary parallel run with the existing system proved that our program covered all possibilities and that the machine could do our work on a volume basis. We were then ready to have RAMAC begin actual parallel operation to the existing system. It will continue to run parallel until our production model arrives in November or December.

In August 1957, we began work on the production model program. Although the two models are similar, they differ enough to require entirely separate programing. Naturally, armed with a year's experience and a well maximized program, we found programing much easier the second time around. Moreover, improvements on the production model allowed us to further maximize our program. In fact, we are now able to have our program hit the minimum time point: it can process a transaction to completion as fast as a line on the material list (which shows what parts are to be drawn from stock) can be printed—about 1½ seconds. The whole application should take approximately 2½ hours a day. At the beginning of October we again went to San Jose to test our new program, this time for one week.

The advantages we expect to gain from RAMAC are:

1. Our records will always be up-to-date. Each transaction will be processed right after it happens rather than within the next nine days. Moreover, these up-to-date records will be easily accessible by inquiry.

2. We will reduce manufacturing lead time. In-line processing by RAMAC, in dramatically reducing the time lag between the physical transaction and its reflection in our records, will thereby dramatically reduce our total lead time.

3. We should reduce our inventory. Up-to-date records and shorter lead times should eventually enable us to reduce inventory substantially.

In addition, we will have better control of source documents than has ever been possible. We are setting up controls to assure that all papers affecting inventory are actually processed.

Such efficiency inevitably raises the question: what will RAMAC displace? Obviously some equipment will become obsolete. We will be able to jettison several transfer posting machines. But the majority of the tabulating equipment now used for material control will simply be released for use on the many new tabulating applications Square D is installing.

The core of the question, however, goes beyond equipment; what about personnel? How many people are we going to eliminate? None! We are saving the clerical work involved in transfer posting and in checking for parts which need to be ordered, but we are adding clerical work by setting up controls we did not and could not have before RAMAC. Thus, we expect our benefits to come, not from salary savings, but from the extensive indirect benefits that will flow from better control of material. **s/p/a**

Worth Reading

"How to Select the Best Machines for Your Office Needs," Walter S. Athearn, *Office Management,* August 57.
Detailed suggestions on how to organize a report to compare duplicating machines.

"Seven Timekeepers Instead of Eighteen," *Modern Office Procedures,* June 57.
Describes how General Electric's Metallurgical Products Department uses call boxes for production timekeeping. Previously production employees reported in person to one of 18 timekeepers in the plant when they started or finished a specified unit of output. Employees averaged five trips a day. Then 28 call boxes were installed and employees reported through them to a central office. This reduced the number of timekeepers to seven.

"It's Time for Time Standards for Clerical Labor," Thomas C. Pitney, *NACA Bulletin,* June 57.
States that a standards program can increase indirect labor productivity by 66 2/3%. Illustrates the installation of sample standards, including a report to management on a department's efficiency.

"The Gold Mine in Your Mail Room," B. E. Sherwood and Howard A. Brooks, *Office Executive,* August 57.
Detailed consideration of the following practices, with annual savings of $100-$600 on each: 1) Use mail in place of phone when possible; 2) Use surface mail in place of airmail if destination is less than 200 miles away; 3) Avoid insurance of low value mail; 4) Use receipted mail in place of registered when possible; 5) Control weight of volume mailings; 6) Use special delivery only when it can be effective.

"Manufacturer's Parts Number Systems," John H. Black, *The Controller,* June 57.
Describes a nine-part number and letter system for parts identification. Explains why mixed number and letter identification is superior to numbers only.

"How a 25-Employee Office Automated Order Processing," Frederick Vogel, *Office Management,* July 57.
Describes improvement in order processing by a company employing 800 men in two plants. A central office of 25 people receives orders from 18 sales offices. Orders are now relayed to the plants by teletype and communication is aided by a private telephone line. Monthly rental for this equipment is $700. Gives a detailed description of the procedure.

"How You Can Convert to Terminal Digit Filing," Winifred Shaugnessy, *Modern Office Procedures,* August 57.
Describes how an insurance company converted to terminal digit filing. Claims one-third reduction in filing personnel resulted.

"Why Your Mailroom May Be Your Most Expensive Department," W. D. Sullivan, *Office Management,* July 57
Detailed explanation of savings possible in large scale mail room operation. Some aspects are applicable to smaller scale operations. Suggests a seven-part program to appraise and improve the operation.

"Soviet Paperwork is Being Mechanized," A. J. Steiger, *The Office,* July 57.
Summary report on data processing equipment in the Soviet Union. Covers tabulating machines and electronic computers.

An editorial

Once a Systems Man

WHEN A MAN ONCE EMBARKS ON A PROFESSIONAL CAREER IN the business world, he usually stays within his chosen field of endeavor for the rest of his working days. Once an engineer, always an engineer; once an accountant, always an accountant; etc., etc. Bankers, laywers, editors, physicists—few of them move into other fields. An exception, however, is the young, up-and-coming profession of systems and procedures. This field is full of new faces, but many of the faces of ten years ago are gone into other pursuits.

The why of it isn't hard to find—a leading clue can be traced in a recent newspaper article announcing that one of the nation's blue-chip companies is launching an advanced management program to create an executive who is a "flexible man who can see beyond his own specialized area; one who easily faces problems and can make ready decisions, and one who is continually learning."

While by no means a jack-of-all-trades, the systems man's daily work requires him to help the operating executives of his company to see beyond their specialized areas and integrate their activities efficiently and effectively with other departments of their organizations. The systems man is truly flexible, (he usually has a dozen projects on his docket, concerning every function of the business), he faces problems easily (these are his bread and butter), he makes decisions readily (and usually has to convince the boss to do likewise), and he is continually learning (always seeking better ways to get work done).

For these reasons the systems man is more likely to be teaching rather than taking the type of advanced management program that more and more companies are using to broaden the industrial horizons of their supervisors and executives. And for these same reasons the systems man frequently is called on by management to move onward and upward into an executive position outside of the systems field.

The effect on the systems and procedures profession is two-fold. First, there is a gradual turnover in membership, with the older men steadily moving upward into more responsible administrative posts in accounting, industrial relations, sales, production and other management fields. And secondly, there is a widening awareness of and interest in the systems and procedures profession by executives in all lines of business enterprise, because in a growing number of cases a review of an executive's background will reveal that he was "once a systems man." **s/p/a**

THE EDITORS

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